Selvam, M.K.P. et al. (2018). Calibration of redox potential insperm wash media and evaluation of oxidation–reduction potentialvalues in various assistedreproductive technology culturemedia using MiOXSYS system. Andrology, 2018.
http://dx.doi.org/10.1111/andr.12461

Calibration of redox potential in sperm wash media and evaluation of oxidation–reduction potential values in various assisted reproductive technology culture media using MiOXSYS system

M. K. Panner Selvam, R. Henkel, R. Sharma and A. Agarwal

Summary

Oxidation–reduction potential describes the balance between the oxidants and antioxidants in fluids including semen. Various artificial culture media are used in andrology and IVF laboratories for sperm preparation and to support the development of fertilized oocytes under *in vitro* conditions. The composition and conditions of these media are vital for optimal functioning of the gametes. Currently, there are no data on the status of redox potential of sperm processing and assisted reproduction media. The purpose of this study was to compare the oxidation–reduction potential values of the different media and to calibrate the oxidation–reduction potential values of the sperm wash medium using oxidative stress inducer cumene hydroperoxide and antioxidant ascorbic acid. Redox potential was measured in 10 different media ranging from sperm wash media, freezing media and assisted reproductive technology one-step medium to sequential media. Oxidation–reduction potential values of the sequential culture medium and one-step culture medium were lower and significantly different ($p < 0.05$) from the sperm wash media. Calibration of the sperm wash media using the oxidant cumene hydroperoxide and antioxidant ascorbic acid demonstrated that oxidation–reduction potential and the concentration of oxidant or antioxidant are logarithmically dependent. This study highlights the importance of calibrating the oxidation–reduction potential levels of the sperm wash media in order to utilize it as a reference value to identify the physiological range of oxidation oxidation–reduction potential that does not have any adverse effect on normal physiological sperm function.

Introduction

In the light of living in an aerobic environment, all cells in the human body, including spermatozoa, are exposed to different oxidation and reduction levels and have to cope with the relevant situation depending on the circumstances a specific cell is in (Naviaux, 2012; Agarwal *et al.*, 2016c,d). Oxidants also known as reactive oxygen species (ROS) are generated from either intrinsic or extrinsic sources (Saalu, 2010; Lavranos *et al.*, 2012; Agarwal *et al.*, 2014b). At low levels, ROS are required for physiological functions involved in the fertilization process, including capacitation, hyperactivation, acrosome reaction, and sperm– oolemma binding (de Lamirande & Cagnon, 1993; Agarwal *et al.*, 2006; de Lamirande & O'Flaherty, 2008; Kothari *et al.*, 2010; Guthrie & Welch, 2012),whereas at high levels, ROS are harmful to spermatozoa.

Silver EW, Eskenazi B, Evenson DP, Block G, Young S & Wyrobek AJ. (2005) Effect of antioxidant intake on sperm chromatin stability in healthy nonsmoking men. *J Androl* 26, 550–556.

Ufer C, Wang CC, Borchert A, Heydeck D & Kuhn H. (2010) Redox control in mammalian embryo development. *Antioxid Redox Signal* 13, 833– 875.

Verma A & Kanwar K. (1998) Human sperm motility and lipid peroxidation in different ascorbic acid concentrations: an in vitro analysis. *Andrologia* 30, 325–329.

Wang X, Sharma RK, Sikka SC, Thomas AJ, Falcone T & Agarwal A. (2003) Oxidative stress is associated with increased apoptosis leading to spermatozoa DNA damage in patients with male factor infertility. *Fertil Steril* 80, 531–535.

Wendel A. (1987) Measurement of in vivo lipid peroxidation and toxicological significance. *Free Radic Biol Med* 3, 355–358.

WHO. (2010) *DoRHaR. WHO laboratory manual for the examination and processing of human semen*, 5th edn. World Health Organization, Geneva.

Zlokovic BV. (2011) Neurovascular pathways to neurodegeneration in Alzheimer's disease and other disorders. *Nat Rev Neurosci* 12, 723–738.